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IN THE UNITED STATES PATENT & TRADEMARK OFFICE  
PATENTS

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Attached are Exhibits A and B (Shore and Trenching Data).

## BACKGROUND OF THE INVENTION

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This application is a continuation in part of U.S. Patent Application Serial No.

10 10/252255.

Attached are Exhibits A and B (Shoring and Trenching Data).

15 (1) My invention relates to a shoring device comprising a piston, cylinder, and an outer cam collar combined with an inner ring. More particularly, this invention relates to a shoring device for trenches with a removable rotating outer cam collar. This outer cam collar encloses an inner ring with a continuous circular indentation along the inner ring circumference. This inner ring also comprises an inner continuous circular lip. My new  
20 outer cam collar insures that the partially enclosed piston does not rotate during use. My new shoring device is intended for, but not exclusively, public works and construction, rescue and other projects in which shoring is necessary.

(2) As workers shore trenches, they must quickly install shoring to prevent collapse of the  
25 trench walls. If shoring is not installed, soil cohesion is lost and it becomes almost impossible to maintain a safe trench. The prior art as best depicted in expired U.S. Pat. 3,851,856(Berg) provides a shoring device with an inlet connecting to a pressure source for expanding the device tightly against trench walls. There is also a cylindrical collar

mounted on one cylinder end, which receives the piston. This **cylindrical** collar extends axially from the cylinder and surrounds the proximal piston end.

(3) Still referring to the Berg device, the cylindrical collar comprises two camming surfaces along the cylindrical collar's proximal edge. Subsequent to cylinder pressurization the piston remains extended by the securing of one camming surface with a pin. In addition, a threaded stud abuts and tightens against the cylinder by an attached handle. This threaded stud penetrates the rotating collar and abuts the cylinder after the cam pin is placed against the camming surface.

(4) This abutting threaded stud prevents relative rotation of the cylindrical collar to the cylinder. The threaded stud also locks the cylindrical collar against the pin, thereby preventing the rotating collar from loosening. However, this threaded stud is the only structure in Berg's device which prevents the cylindrical collar from rotating after cessation of the gas pressure.

(5) Furthermore, Berg's threaded stud only contacts one point along the cylinder exterior surface and weakens the cylinder structure after each application. Inevitably, the entire cylinder must be replaced, and this replacement is expensive and time consuming. In contrast, my continuous circular indentation prevents the flat threaded pin furthestmost point from skidding along the cylinder surface. The cylinder is not weakened by repeated contract, because the outer cam collar provides the direct contact surface. My outer cam

collar is more economical to replace, and protects the cylinder from wear and tear from the threaded pin.

5 (6) In addition, my inner ring comprises a continuous circular lip which abuts the piston and prevents it from falling from the cylinder or becoming a projectile during operation. My new inner ring engages one cylinder end, thereby reducing the possibility that the piston will fall from the cylinder during operation. This metal lip abuts the piston to prevent piston lateral movement, which is an important safety advantage which the Berg device does not have.

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(7) In my invention the outer cam collar encloses the inner ring and comprises the threaded pin which tightly abuts the circular continuous indentation. The cam edges, together with a straight metal cam pin, prevent counter-clockwise rotation of the outer cam collar. My improved shoring device is engineered to assist underground workers in compliance with the OSHA regulation governing excavations, i.e., 29 C.F.R. 1926.650. This group includes, but is not limited to, sewer contractors, plumbers, gas companies, telephone companies, municipal public works departments and fire rescue services. The principle goal of my shoring device is to provide the necessary physical support which ensures a work environment safe from collapse.

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(8) In particular, shoring is the placement of cross bracing and other components within a trench to support trench walls. There are two important theories of shoring: first is the theory of "zero-movement", in which shoring is designed to prevent wall movement.

Shoring is not sufficiently strong to retain a moving wall of soil: it merely prevents a soil wall from initially moving. The second theory of shoring is designated the "Arch Effect." Shoring is effective because it creates forces as it pushes against trench walls. The network of cross braces and uprights or wale-plates creates an arch effect which retains soil. The  
5 shoring and cross bracing actually retains soil, and not the plywood or sheeting.

(9) An operator applies plywood or sheeting to prevent surface soil from falling and injuring a worker. To achieve "zero movement" and the "arch effect," all gaps and voids must be filled where the cross brace bears on the trench wall. Other than the mandatory  
10 inspection for damage before each use and an occasional cleaning, there are no maintenance requirements.

(10) My preferred pneumatic shoring device also comprises a contiguous pressurized gas channel through the cylinder to the piston. In the best mode, this contiguous pressurized  
15 gas channel includes a circular channel segment along the lower floor surface of a cylinder rubber end cup.

## SUMMARY OF THE INVENTION

5 (11) My improved shoring device is much safer than, yet remains just as cost effective, as the prior art. The new crucial safety feature comprises an inner ring with a continuous circular inner lip, together with an outer cam collar with a threaded pin within a boss. The outer cam collar concentrically encloses the inner ring, and both the outer cam collar and inner ring concentrically enclose a cylinder which contains a piston.

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(12) Release of the outer cam collar in a counterclockwise direction requires the operator to manually twist the threaded pin counter-clockwise, thereby releasing it from a continuous circular indentation along the inner ring exterior surface. The inner ring greatly reduces the likelihood that the piston will become a projectile, because a rubber  
15 piston cup attached to a cylinder plug cannot move beyond the continuous circular lip. The inner ring also comprises an inner circular continuous lip which abuts the distal piston end when my shoring device 100a is fully assembled. The inner circular continuous lip prevents the piston from becoming a projectile and falling from the cylinder.

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(13) The piston is cylindrical in shape and inserts within a cylinder of greater diameter. The piston also comprises a plurality of aligned apertures, into which a straight metal cam pin inserts. This metal cam pin, in combination with the outer cam collar, prevents

the piston from retracting into the cylinder, once the air pressure is removed. This straight metal cam pin is inserted into a pair of piston apertures which are closest to the outer cam collar edge. The operator then manually rotates the outer cam collar until it abuts this inserted straight metal cam pin. After this last step, the operator manually rotates the threaded pin within its boss until the threaded pin abuts the floor of the inner ring's circular continuous indentation.

(14) The inner ring encloses the proximal cylinder end and is mechanically attached to the cylinder with at least two screws. Preferably, my inner ring attaches to the cylinder with allen screws (threaded with hexagonal head depressions). With my shoring device, the initial lateral extension of my assembled improved shoring device occurs whenever pressurized air enters the cylinder during a trench application.

(15) During removal of an installed shoring device pressurized air is re-introduced. Next there is counter-clockwise release of the outer cam collar prior to disengagement of the straight metal cam pin and removal of the pressurized air. In actual field operations, the operator does not remove the air pressure from the shoring device until he or she has moved to a safe position removed from the device.

(16) Each shoring device also comprises two removable swivel side plates. One side plate reversibly attaches to the most distal piston end, while the other similarly attaches to the most proximal cylinder end. My removable swivel side plates comprise adjustable set screws for engagement of wood shoring boards or aluminum wale-plates. Each preferred

set screw is approximately 1/4 inch in diameter, and comprises twenty threads per inch. Each preferred set screw is also approximately one inch in length. However, other side plates or end adapters are also within the scope of my invention, and may be even preferably for primarily vertical or angled applications, such as buildings or vehicles.

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(17) In the preferred embodiment my pneumatic pin and collar shoring device also comprises a cylinder plug. Cylinder plug is hollow at its proximal end to accommodate one removable swivel side plate. The remaining approximate one-half of the cylinder plug is solid metal and comprises a continuous channel for compressed air. In the best mode, the cylinder plug comprises a cylinder rubber end cup at its distal plug end.

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Cylinder rubber end cup more efficiently prevents air leaks from the air channel within metal cylinder plug.

(18) In the best mode, the cylinder end cup comprises apertures and a circular channel,

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which contribute to the most efficient airflow from cylinder plug distal end. More preferably, air channel segments lie along the lower floor surface of the cylindrical rubber end cup. This circular channel segment comprises a contiguous aperture through which pressurized air from a gas inlet evenly and quickly seals the raised edge of a piston rubber end cup. The prior art cylinder plug comprises a circular groove around the

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circumference of the metal cylinder plug, and into which groove a rubber o-ring is inserted.



(19) In the best mode, my preferred improved shoring device is assembled by inserting the piston so that its piston rubber end cup initially abuts cylinder rubber end cup. The inner ring is next inserted over the cylinder end until its circular metal inner lip engages the distal cylinder end. The operator then bolts the inner ring is then bolted to the  
5 cylinder. The outer cam collar is next positioned so that it encloses the inner ring.

(20) The outer cam collar has limited movement along the cylinder, but it can be manually rotated and then locked to the inner ring with the threaded pin. At least approximately one-third of the longitudinal axial length of the piston must always remain  
10 within the cylinder. After the operator fits the outer cam collar over the inner ring, he or she finally inserts the removable swivel side plates at the distal and proximal end of the shoring device.

(21) For pneumatic applications, my pin and collar shoring device is particularly suited  
15 for situations in which only one air pressure value is available. Any single specific air pressure value is generally in the range of approximately 115-150 psi (pounds per square inch). For support of a car or building, my shoring device is manually extended until resistance is felt. Then the operator inserts a straight metal cam pin into appropriate piston apertures. He or she then manually tightens the outer cam collar by rotating the  
20 threaded pin until the threaded pin tightly abuts the continuous circular indentation.

(22) Accordingly, it is a goal of my invention to provide a more comprehensive reliable anti-rotational mechanism for a piston within a cylinder.

(23) It is another goal of my invention to provide a safer locking mechanism with an outer cam collar in combination with an inner ring, for a pneumatically driven shoring device.

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(24) It is another goal of my invention to provide a device which prevents the piston from ejecting from the cylinder.

(25) It is another goal of my invention to provide cast aluminum handles for manual  
10 rotation of outer collar.

(26) These as well as other features of my device are described further in the drawings and the detailed description of the preferred embodiment and other embodiments

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## BRIEF DESCRIPTION OF THE DRAWINGS

- (27) Figure 1 illustrates an anterior view of operator installing a plurality of shoring  
10 devices within a trench.
- (28) Figure 2 illustrates a longitudinal prospective view of my improved shoring device  
with an outer cam collar.
- 15 (29) Figure 3 illustrates a partial transverse longitudinal view of a shoring device through  
view line 3-3.
- (30) Figure 4 illustrates a cross-sectional view of Figure 3 taken through view line 4-4.
- 20 (31) Figure 5 illustrates a cross-sectional view of Figure 3 taken through view line 5-5.
- (32) Figure 6 illustrates a cross-sectional view of Figure 3 taken through view line 6-6.
- 25 (33) Figure 7 illustrates an exploded view of the shoring device.
- (34) Figure 8 illustrates an isolated view of lower floor surface of cylinder end cup.  
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- (35) Figure 9 illustrates a close up cross-sectional view of Figure 9 taken through view  
line 10-10.

(36) Figure 10 illustrates an isolated partial anterior view of inner ring with a close up cross-sectional view of the outer cam collar and threaded cam pin.

5 (37) Figure 11 illustrates a close up of isolated prior art cylinder plug.

(38) Figure 12 illustrates a close up isolated partial perspective view of a prior art side plate.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT  
AND OTHER EMBODIMENTS

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(39) Referring initially to Figures 2 and 3 of the preferred embodiment, my improved shoring device 100a comprises a piston 102, cylinder 101, an outer cam collar 107a, and an inner ring 113a. Shoring device 100a is particularly suited for shoring of trench walls, by using compressed gas to laterally extend piston 102. Shoring device 100a is especially suited for situations in which the gas source has only one designated numeric pressure.

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However, other sources of appropriate lateral force are also within the scope of my invention. My shoring device 100a is preferably approximately 43 inches long in its maximum extended configuration, and approximately 33 inches in its most retracted configuration. Three other satisfactory lengths are as follows:

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(40) approximately 25 inches when fully retracted and approximately 30 inches when fully extended;

(2) approximately 45 inches when fully retracted position and approximately 65 inches when fully extended; and

(3) approximately 67 inches when fully retracted and approximately 102 inches when fully extended.

(41) Other diameters and lengths are also within the scope of my invention. Circular rubber end cups 155b, 156 *infra*, add approximately two inches to every model, so that only cylinder and piston length varies.

*Cylinder 101 and swivel side plates 103a, 103b*

(42) Still referring to Figures 2 and 3 of the preferred embodiment, my improved shoring device 100a comprises a cylinder 101. Cylinder 101 is hollow, preferably approximately 15 inches in length and approximately 3.0 inches in interior diameter. Cylinder wall 101c is preferably approximately one-quarter of an inch (1/4 ") thick. Cylinder 101 has a proximal cylinder end 104a and distal cylinder end 104b.

(43) Cylinder 101 also comprises a removable swivel proximal cylinder side plate 103a whenever shoring device 100 is fully assembled. Swivel proximal cylinder side plate 103a is identical in structure, size and function to removable swivel distal piston side plate 103b, *infra*. Each swivel side plate 103a, 103b comprises a plate 103e, 103f which is preferably approximately five inches in length and width. Each swivel side plate 103a, 103b also comprises a central screw 135a, 135b respectively, and a central segment 136a, 136b respectively. Swivel proximal and distal side plates 103a, 103a respectively also each comprise at least one adjustable first and second set screw 120a, 120b respectively, for engagement with wood shoring boards and/or aluminum wale-plates 175 (Figure 1).

(44) Each central segment 136a, 136b respectively comprises a first and second swivel groove 137a, 137b respectively. First and second insert portions 138a, 138b respectively attach within grooves 137a, 137b respectively, by their first and second insert ridges 139a, 139b respectively.

(45) Each groove 137a, 137b containing an insert ridge 139a, 139b respectively prevents a swivel proximal or distal side plate 103a, 103b respectively, from swiveling in an unlimited manner. Removable swivel side plates are well known in this particular equipment industry. However, other side plates, base plates or attachments are also within the scope of my invention.

(46) Still referring to Figures 2 and 3 of the preferred embodiment, at proximal cylinder end 104a is proximal side plate detente pin 105a. Proximal side plate detente pin 105a connects cylinder 101 to swivel cylinder proximal side plate 103a by insertion through (i) first and second proximal side plate swivel apertures 103c, 103d respectively and; (ii) congruently aligned first and second cylinder end apertures 116a, 116b.

(47) First and second proximal side plate swivel apertures 103c, 103d oppose each other at approximately 180 degrees. Cylinder end apertures 116a, 116b also oppose each other at approximately 180 degrees. Cylinder end apertures 116a, 116b can congruently align with swivel apertures 103c, 103d whenever swivel proximal cylinder side plate 103a

inserts into cylinder 101. Cylinder end apertures 116a, 116b are approximately one and 3/4 inches from cylinder proximal end 104a.

(48) Referring now to Figures 3 and 7 of the preferred embodiment, approximately three inches from inserted proximal side plate 103a, and approximately 90 degrees from proximal detente pin 105a, is compressed gas inlet 111. Compressed gas inlet 111 connects shoring device 100a to an external source of compressed gas through cylindrical plug 155, *infra*.

(49) As seen in Figures 2 and 7, small circular vents 112a, 112b, 112c, 112d (generically small circular vents 112) for gas exhaust are aligned along a cylinder circumference at intervals of approximately 90 degrees to each other. Small circular vents 112 are approximately one quarter inch in diameter. In the preferred embodiment there are four small circular vents 112, but other numbers are also satisfactory.

#### *Proximal cylinder plug 155*

(50) Referring now to Figures 3, 7, and 11, cylinder plug 155 is part of cylinder 101, and cylinder plug 155 is contiguously attached to cylinder 101 by first and second set screws 160a, 160b respectively. First and second set screws 160a, 160b oppose each other at approximately 180 degrees along cylinder 101. Cylinder plug 155 abuts proximal cylinder end 104a by circular contiguous ledge 155a. Metal contiguous ledge 155a is also the cylindrical component into which compressed gas inlet 111 inserts. Cylinder swivels



proximal side plate 103a inserts into cylinder plug 155 proximal to circular contiguous ledge 155a.

(51) Still referring to Figures 3 and 7, the inner diameter of cylinder plug 155 is approximately 3.5 inches. Cylinder plug wall 155f is preferably approximately 2/3 (two-thirds) inch in thickness at proximal plug end 154a. Cylinder plug interior 155d comprises a proximal round metal barrier 155e which abuts fully inserted swivel proximal cylinder side plate 103a. .

(52) Referring to Figures 3 and 7, in the best mode cylinder plug 155 at distal plug end 155q comprises cylindrical end cup 155b. Cylindrical end cup 155b comprises an outer raised circular rim 155c, which faces a piston rubber end cup 156, *infra*, within a fully assembled shoring device 100. Cylindrical end cup 155b comprises the same shape, dimensions and material as piston rubber end cup 156, *infra*. Cylindrical end cup 155b abuts piston rubber end cup 156 by raised circular rim 155c, whenever piston 102 is completely inserted within cylinder 101.

(53) Cylindrical end cup 155b also comprises a cylindrical end cup floor 155d with centrally located bolt aperture 155j. Plug bolt 155m inserts into bolt aperture 155j and thereby attaches distal plug end 155q to cylinder end cup 155b. Cylinder washer 155p surrounds plug bolt 155m.

(54) Initially referring to Figure 9, in the best mode cylindrical end cup floor 155d comprises an upper end cup floor surface 169a and a lower end cup floor surface 169b.

Also referring to Figure 10 of the preferred embodiment, cylinder end cup 155b comprises a lower air aperture 158b within its lower end cup floor surface 169b, and upper air aperture 158a within upper end cup floor surface 169a. Lower and upper air apertures 158a, 158b respectively are integrally connected to each other by (i) a first air  
5 channel segment 164a within rubber end cup floor surface 169b; and (ii) a short air channel segment 164e traversing rubber cylinder end cup floor 155d.

(55) As best seen in Figures 4 and 9, in the best mode first air channel segment 164a is circular, approximately one inch in exterior diameter and approximately one-quarter inch  
10 in depth along lower cylindrical end cup floor surface 169b. As best seen in Figure 10, short air channel segment 164e is adjacent and parallel to bolt aperture 155j within end cup floor 155d. Short air channel 164e connects circular air channel segment 164a to upper aperture 158a. However, other embodiments of my invention need not comprise a first air channel segment 164a which is circular.

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(56) Referring to Figures 3 and 7, lower air aperture 158a is congruent and contiguous with second air channel segment 164b within cylinder plug 155. Air channel segment 164b is adjacent to and parallel to longitudinal midline 163 of cylindrical plug 155, as seen in Figure 4. In the preferred embodiment, second air channel segment 164b is  
20 continuously connected to third air channel segment 164c. Third air channel segment 164c is approximately perpendicular to second air channel segment 164b. Preferably both air channel segments 164b and 164c are linear in form.

(57) Second air channel segment 164b leads towards the outer metal surface of cylinder plug 155, and is continuous with gas inlet 111. Gas inlet 111 is continuously connected to an external source of pressurized gas, such as CO<sub>2</sub> or air. Consequently when air is introduced from an exterior source, there is a continuous pressurized gas channel through: gas inlet 111; third and second air channel segments 164c, 164b; lower air aperture 158b; circular first air channel segment 164a, short air channel segment 164e; and finally upper air aperture 158a.

(58) After passing through this pathway, almost instantaneously this pressurized air seals piston end cup raised circular rim 156a against inner cylinder wall 101cc. Figure 4 illustrates the physical continuity of lower aperture 158a in rubber end cup 155b, with metal distal cylindrical plug end 155q, with respect to bolt aperture 155j and adjacent second air channel segment 164b.

(59) Referring to Figure 11 for other embodiments, prior art cylinder plug 155 comprises a single end aperture 155ss which is continuous with second air channel segment 164b. Approximately two inches from cylindrical plug end 155q along a cylinder plug circumference 155u is circular groove 155t. Circular groove 155t contains an appropriately sized O-ring 155v. O-ring 155v prevents air leakage from cylinder end plug 155. Prior art cylinder plug 155 is available from Airshore, *infra*.

*Piston 102*

(60) Referring initially to Figures 2 and 3 of the preferred embodiment, piston 102 is hollow and cylindrical in shape, approximately thirteen (13) inches in length, and approximately two and one-quarter inches in inner diameter. However, other lengths and diameters are also within the scope of my invention. Piston 102 comprises a piston wall 102k, which is approximately 1/4-inch (one-quarter) inch in thickness. Piston 102 is narrower in diameter than cylinder 101, into which piston 102 inserts in a removable manner.

(61) Along its longitudinal axis piston 102 comprises four linearly aligned parallel sets of piston apertures 128a, 128b, 128c, 128d; 128e; 129a, 129b, 129c, 129d, 129e, 129f; 130a, 130b, 130c, 130d, 130e; and 131a, 131b, 131c, 131d, 131e, 131f (generically opposing piston apertures 128, 129, 130, 131). Representative apertures 128, 129, 130, 131 are best seen in Figures 3 and 7, and are preferably approximately 1 and 1/2 inches in diameter.

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(62) Each set of piston apertures 128, 129, 130, 131 is preferably approximately 90 degrees from each adjacent aligned set. However, individual adjacent apertures are preferably aligned at the midpoint of adjacent apertures, as best seen in Figure 3.

Opposing sets 128/130 and 129/131 are approximately 180 degrees from each other, so that straight metal cam pin 170 is inserted through them simultaneously, as best seen in Figure 7.

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(63) Four linearly aligned sets are preferred, but other numbers of linearly aligned sets are also within the scope of my invention. There are also preferably two opposing sets of five apertures per linearly aligned set (128, 130), and two opposing sets of six apertures (129, 131) per linearly aligned set. However, other numbers of piston apertures are also  
5 within the scope of my invention.

(64) Still referring to Figures 3 and 7, in a fully assembled shoring device 100a, piston 102 is closed at most distal end 102b by swivel piston distal side plate 103b. Swivel piston distal side plate 103b is attached within piston 102 by insertion of piston detente  
10 pin 105b within:

(i) piston apertures 128/130 or 129/131 and

(ii) first and second swivel side plate apertures 141a, 141b respectively.

Piston apertures 128/130 or 129/131 and side plate apertures 141a, 141b must be congruently aligned with each for insertion of piston detente pin 105b.

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(65) Still referring to Figures 3 and 7, at its proximal end 102a piston 102 is capped by metal piston end wall 102c. Metal piston end wall 102c is secured to piston 102 by first and second opposing screws 164ff, 164gg respectively. Metal piston end wall 102c is flush with piston wall 102k, and is approximately one-half inch in thickness at its  
20 proximal end.

(66) A piston rubber end cup 156 is secured to metal piston end wall 102c by piston bolt 156d extending through metal washer 156e. In the center of piston rubber end cup flat

circular floor 156f (which is preferably approximately three inches in diameter) is piston bolt 156d. In other embodiments, piston end cup 156 comprises identical apertures 158 and channel segments 164 to cylinder end cup 155b. In fact, in the best mode mass production of end cups 155b, 156 is the most economical approach. However, in these  
5   embodiments apertures and channels in end cup 156 are covered with a large washer because they have no function in piston end cup 156. In the preferred embodiment and best mode, piston end cup 156 comprises no air apertures or air channel segments of any type. Please see Figures 3 and 7.

10   (67) Circular piston rubber end cup 156 comprises raised circular rim 156a, and raised circular rim 156a is preferably approximately one inch in height. Circular piston rubber end cup 156 immediately flares, and thereby airseals circular raised rim 156a whenever compressed gas enters inlet 111 and flows through air channel segments 164 and air apertures 158a, 159b. This air seal occurs by compression of raised circular rim 156a  
15   against interior cylindrical wall surface 101cc by pressurized gas.

#### *Inner ring 113h*

(68) Referring initially to Figures 5 and 7 of the preferred embodiment, inner ring 113h encloses distal cylinder end 104b in my fully assembled shoring device 100a. Inner ring  
20   113h is shaped as a hollow cylindrical segment and has an inner wall surface, an outer wall surface, and a wall thickness. Inner ring 113h attaches to cylinder 101 by first inner set screw 113a and second inner set screw 113b. Inner set screws 113a, 113b oppose each other at approximately 180 degrees along cylinder 101. Inner ring 113h is preferably

approximately three inches in width parallel to the long axis of cylinder 101, and approximately twelve and one-half inches in outer circumference. Inner ring 113h has a proximal ring edge 113c and a distal ring edge 113d, both of which are beveled.

5 (69) Inner ring 113h is preferably approximately 1/4 inch in thickness at distal ring edge 113d and proximal ring edge 113c. Referring to Figure 10, inner ring 113h also comprises a metal inner continuous circular lip 180 at beveled distal ring edge 113d. Metal inner continuous circular lip 180 is continuous with beveled distal ring edge 113d, and lip 180 is approximately perpendicular thereto. Metal inner continuous circular lip  
10 180 fits over cylinder distal end 104b and prevents inner ring 113h from sliding along cylinder 101(in addition to opposing inner set screws 113a, 113b).

(70) Metal inner continuous circular lip 180 is approximately one-half inch wide, approximately one-half inch in thickness, and approximately three inches in inner  
15 diameter in the preferred embodiment. However, other dimensions of circular metal lip 180 are within the scope of my invention.

(71) Referring to Figures 7 and 10 of the preferred embodiment, approximately 1 and 5/8 inches above proximal ring edge 113c lies circular continuous indentation 113i. Circular  
20 continuous indentation 113i is uniform in width (approximately 3/4 inch) and depth (approximately 1/8 inch). First and second continuous indentation walls 113p, 113q respectively are perpendicular to circular continuous indentation floor 113j. First and second continuous indentation walls 113p, 113q are also the same height as indentation

depth (i.e, approximately 1/ 8 inch). However, other width and depth measurements are also within the scope of my invention

5     *Outer cam collar 107t*

(72) Referring initially to Figure 2 of the preferred embodiment, outer cam collar 107t can move axially from piston distal end 102b to cylinder distal end 104b. As seen in Figures 3 and 5 of the preferred embodiment, after assembly outer cam collar 107ht completely encloses inner ring 113h.

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(73) Outer cam collar wall 107c is preferably approximately one-quarter (1/4) inch in thickness and approximately four and one-quarter (4 and 1/4) inches at its greatest axial width. In the preferred embodiment, outer cam collar 107t has an outer diameter of approximately 13 inches. Outer cam collar 107t is approximately four inches wide at its  
15     narrowest outer width. However, other widths, diameters and thickness are also within the scope of my invention.

(74) Referring now to Figures 6 and 7 of the preferred embodiment, outer cam collar 107t comprises a plurality of handles 115a, 115b, 115c, etc. (generically handles 115).

20     Handles 115 are integral oblong components of outer cam collar 107t, and preferably are of two types:

(i) approximately four and one-quarter (4 and 1/4) inches in axial and 1/3(one third) inch in height(115b length (115b, 115c, 115e, 115f); and



(ii) approximately four and one-quarter (4 and 1/4) inches in length and one and three quarters (1 and 3/4) inches in height (115a, 115d).

(75) In the preferred embodiment, there are six handles; four of these six handles are the shorter height handle 115. However, other heights, shapes, lengths, numbers and types of handles are also within the scope of my invention. Referring to Figure 7, handles 115 are aligned parallel to each other and approximately perpendicular to the midline circumference 108 of outer cam collar 107t. Preferably, approximately 3 and 1/2 inches separate adjoining handles 115b, 115c, while approximately 3 and 1/2 inches separate adjoining handles 115e and 115f. Outer cam collar 107t also comprises a threaded vertical screw 176, by which metal cam pin 170 is tethered to outer cam collar 107t by steel lanyard 145.

(76) As best seen in Figures 6 and 7 of the preferred embodiment, proximal outer cam collar edge 107a is uniformly round and smooth. Proximal outer cam collar edge 107a is preferably approximately one quarter (1/4) inch in uniform thickness. Distal cam collar edge 107b comprises 180 degree-opposing vertical first and second stop faces 107f, 107g respectively. Continuous with stop faces 107f, 107g are corresponding first and second sloping cam edges 107h, 107i respectively. Sloping cam edges 107h, 107i form cam surfaces for abutting metal cam pin 170, *infra*.

(77) Referring now to Figures 7 and 10 of the preferred embodiment, outer cam collar 107t comprises inner collar surface 107k. Inner collar surface 107k comprises wider

circular proximal step 167 and narrow circular distal step 168. Each step 167, 168 is axially aligned along cylinder 101, so distal narrower step 168 is nearest distal piston end 102b in assembled shoring device 100a. Wider proximal step 167 comprises a wider inner diameter. This wider diameter allows outer cam collar 107h to slide over

5 (i) piston 102, and then

(ii) inner cam ring 113h until circular metal lip 180 engages narrower distal step 168.

(78) Wider circular proximal step 167 is approximately four inches in interior diameter and approximately preferably 2.8 inches in interior axial length. Circular distal narrower  
10 step 168 is preferably approximately three inches in interior diameter and approximately 2.5 inches in interior axial length. Without narrow circular distal step 168, outer cam collar 107t slides along cylinder 102 prior to adjustment with threaded cam pin 185, *infra*.

15 (79) As best seen in Figure 7, between first and second short handles 115b, 115c respectively is an abutting element which penetrates outer cam collar 107t. In the preferred embodiment, abutting element comprises a threaded pin 181 which is removable from an integral threaded boss 181a. Threaded pin 181 comprises a pin handle 181b which is approximately three and one-half inches in length. Threaded stem  
20 181c inserts into threaded interior of handle 181b and is further attached with suitable solder. Integral threaded boss 181a is approximately one inch in diameter and one-half inch in height.

(80) Threaded stem 181c is approximately one inch in length and approximately three-eighths inch in diameter at furthestmost stem point 181e. Threaded stem 181c penetrates cam collar wall 107c through threaded boss 181a and threaded wall aperture 181d. When threaded stem 181c sufficiently protrudes through threaded wall aperture 181d,  
5 furthestmost stem point 181e tightly abuts indentation floor 113j (whenever the operator manually turns threaded pin handle 181d as tightly clockwise as possible).

(81) Other lengths and diameters of threaded pins 181 are also within the scope of my invention. To release threaded pin 181, the operator turns threaded pin handle 181b  
10 counter clockwise, so furthestmost stem point 181e releases from indentation floor 113j. After release, the operator can rotate outer cam collar 107t or move it along piston 102. Because indentation floor 113j is continuous and smooth, threaded pin 181 can abut within the entire width and circumference of indentation floor 113j.

15 (82) In addition my inner ring design enables the operator to loosen the threaded pin 181 from contact with indentation floor 113j while threaded in 181 remains within the continuous indentation walls 113p, 113q. This feature allows the outer cam collar 107t to rotate during transport or installation while eliminating inadvertent movement of outer cam collar 107.

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#### **Prior art U-shaped removable side plate 570**

(83) Referring now to Figure 12, prior art U-shaped removable side plate 570 is useful  
25 for trench applications of preferred pneumatic shoring device 100a. It also attaches to

vertical and angled non-pneumatic embodiments of shoring device 100a which support collapsed buildings and unstable motor vehicles. U-shaped removable side plate 570 attaches to proximal cylinder end 104a or distal piston end 102b. Removable U-shaped side plate 570 comprises a circular (in cross-section) solid metal base 571. Solid metal base 571 supports U-shaped flat plate 573 upon a flat horizontal supporting surface 8. Solid metal base 571 also comprises a first and second solid metal base apertures 571a, 571b respectively. Solid metal base apertures 571a, 571b oppose each other at approximately 180 degrees.

(84) Whenever U-shaped removable side plate 570 inserts into distal piston end 102b or proximal cylinder end 104a, the operator congruently aligns apertures 571a, 571b with cylinder apertures 116a, 116b or piston apertures 128/130, 129/131, as the case may be. The operator then inserts metal détente pin 151j through these congruently aligned four apertures, to secure removable U-shaped side plate 570 within either cylinder end 104a or piston end 102b. U-shaped removable side plate 570 similarly inserts into distal piston extension end 500b or piston adjustable add-on segment 520.

(85) Still referring to Figure 12, solid metal base 571 has an upper circular metal base surface 571g, to which U-shaped flat plate 573 attaches by large allen screw/ washer 573g. U-shaped flat plate 573 comprises a flat horizontal upper surface 573a. Upper surface 573 has small first, second, third and four base apertures 573b, 573c, 573d, 573e respectively. U-shaped flat plate 573 is approximately 0.25 inch in thickness. Piston extensions 500 and piston add-on segments 520 are interchangeably attached to removable U-shaped side plate 570 or removable swivel side plates 103a, 103b.

(86) Still referring to Figure 12, U-shaped flat plate 573 has a first opposing edge 574a and second opposing edge 574b. Integrally attached to each edge 574a, 574b is a first and second upwardly protruding side wall 575a, 575b respectively. Each upwardly protruding side wall 575a, 575b is approximately 2.0 inches in height and approximately 3/16 inch in thickness. Upwardly protruding side walls 574a, 575b engage wooden boards within a trench or grasp a wooden beam of varying widths. Representative widths (and lengths) of wooden boards include: six inches by six inches; eight inches by eight inches, or four inches by four inches. However, other sizes and dimensions are also within the scope of my invention.

(87) Still referring to Figure 11, each upwardly protruding side wall 575a, 575b contains first and second small side wall apertures 576a, 576b and third and fourth small side wall apertures 577a, 577b respectively (generically small side wall apertures 576, 577).

Small side wall apertures 576, 577 are each located at upper corners of the corresponding upwardly protruding side wall 575a, 575b, as seen in Figure 11. Apertures 573 and small side wall apertures 576, 577 provide insertion points for nails or screws into the supported object, thereby reducing inadvertent movement. Small roll pin 573j adjacent to allen screw 573 also attaches solid metal base 571 to U-shaped flat plate 573.

(88) Prior art removable U-plates 570 are made of 6061-T6 aluminum and are available from:

Airshore

Unit 3, 19695 92A Avenue

Langley, BC V1M 3B3

Canada.

- 5     However, other embodiments of U-shaped removable plates 570 are also within the scope of my invention.

#### **Assembly of One Shoring Device 100a**

- 10     (89) Each shoring device 100a is assembled exterior to a trench or structure to be shored or propped. The operator initially bolts rubber piston end cup 156 to proximal piston end 102a, while cylinder circular end cup 155b is bolted to distal end 155i of cylinder plug 155. Cylinder plug 155 is then inserted into proximal end 104a of cylinder 101 and attached thereto with screws 160a, 160b. The operator then inserts piston 102 into distal  
15     end 104b of cylinder 101 until cylinder rubber end cup 155b abuts piston circular rubber end cup 156.

- (90) The operator now slides inner ring 113h over cylinder 101 until metal continuous inner circular metal lip 180 engages cylinder distal end 104b. The operator attaches inner  
20     ring 113h to cylinder 101 with two screws 113a, 113b, and then positions outer cam collar 107t over inner ring 113h.

- (91) As the last assembly step, the operator inserts removable swivel endplate 103a into proximal cylinder end 104a, and inserts removable swivel endplate 103b into distal piston  
25     end 102b. The operator aligns first and second cylinder apertures 116a, 116b to

congruently align with proximal swivel side plate apertures 103c, 103d. He or she then takes a proximal swivel side plate detente pin 105a and inserts it through properly aligned side plate apertures 103c,103d and cylinder apertures 116a,116b.

- 5 (92) Swivel side plate detente pin 105a now attaches proximal swivel side plate 103a within cylindrical plug 155. The operator inserts distal swivel side plate detente pin 105b through congruently aligned opposing piston apertures 128/130 or 129/131 and second swivel side plate apertures 141a,141b. Distal swivel piston side plate detente pin 105b now attaches removable distal swivel side plate 103b to distal cylinder end 102b.
- 10 Tethered cam metal pin 170 is preferably temporarily inserted through an empty piston aperture, to prevent dragging and dangling outside the shoring area.

### **Operating Shoring Device 100a**

- (93) My improved pin and collar shoring device 100a should never be operated except
- 15 under lawful conditions and at the site of the shoring operation, *infra*. My improved shoring device 100a operates in an extended position in which pressurized air initially forces piston 102 laterally from cylinder 100. Other applications such as vehicles and buildings require manual extension, as discussed *supra*.

- 20 (94) To maintain this extended lateral piston position in pneumatic and non-pneumatic applications, the operator first manually rotates outer cam collar 107h clockwise, until a specific aperture 128, 129, 130, 131 is closest to sloping cam surface 107i or 107h. Please see Figure 7 (129a/131a).

(95) He or she then inserts tethered metal cam pin 170 within that closest piston aperture and through its 180-degree opposing piston aperture. For example, if the operator inserts straight cam metal pin 170 through piston aperture 128b, then straight cam metal pin 170  
5 also inserts within opposing piston aperture 130b. The operator continues to rotate outer cam collar 107t clockwise until straight metal cam pin 170 firmly abuts the closest sloping cam surface 107i or 107j, as the case may be. After abutment occurs, the operator obtains a maximum tight fit by rotating threaded pin 181 until he or she detects the abutment of furthestmost point 180e with indentation floor 113d.

10

(96) Without additional pressurized air flowing to my shoring device 100a cylinder 101 and piston 102 remain laterally extended, This extension continues because outer cam collar 107t and inner cam ring 113h prevent counter-clockwise rotational piston movement and subsequent slippage from cylinder 101. To disengage outer cam collar  
15 107t the operator rotates outer cam collar 107t in a counter-clockwise direction and releases threaded pin 181 by rotating pin handle 181b counter clockwise. He or she continues to rotate outer cam collar 107t until straight metal cam pin 170 no longer abuts either sloping cam surface 107i, 107j. The operator then removes straight metal cam pin 170.

20

(97) Vent holes 112 within cylinder wall 101d, release gas from cylinder 101 whenever piston 102 extends from cylinder 101 sufficiently for piston rubber end cup 156 to pass beyond vent holes 112. As a result of vent holes 112, no further extension of shoring



device 100a occurs, because the air pressure dissipates. The preferred number of vent holes 112 is four, but other numbers are also satisfactory.

### **Installation of Multiple Shoring Devices 100a in an Excavation or Trench**

- 5 (98) The operator always installs a plurality of my improved shoring devices 100a in progression from the top of the trench to the bottom of the trench. For horizontal and vertical placement requirements of trench supports for pneumatic shoring devices 100a, please see attached Exhibits A (Timber and Plywood) and B (Aluminum Wale-Plates). The best mode installation and removal procedure proceeds as follows:
- 10 (99) 1. The operator initially determines appropriate reinforcement measurements according to 29 C.F. 1926.652 (**Federal Register**, Vol. 54(209): 45961-62, October 31,1989) (Requirements for protective systems). Under this regulation, the engineer's data in Exhibits A and B determines the horizontal and vertical spacing between wale plates or wood supports, according to trench depth and soil
- 15 type. However, these measurement in Exhibits A and B are only application to my preferred embodiment shoring device 100a. The measurements must be recalculated for other embodiments or sizes of shoring device 100a, as well as other soil types and trench depth. Soil type A –25 comprises cohesive soils with unconfined compressive strength of at least 1.5 tons per square foot (uch as clay
- 20 and cemented soils). Class B-45 is cohesive soil with an unconfined compressive strength greater than 0.5, but less than 1.5 tons per square foot (such as sandy loam and city loam. Department of Labor, 29 C.F.R. 1926 (**Federal Register**, Vol. 54 (209): 45939, October 31, 1989) .

(100) For example:

(a) The installer can position a wooden board which is approximately 2 inches thick by 10 inches wide (designated as an "upright" in this industry) on each opposing trench wall surface. The operator can force these boards further into each trench wall using pressurized air, *infra*. Please see Figure 1. The length of these boards varies, depending upon the dimensions of a trench or other application.

(b) In other circumstances, the operator can position an approximately 12-inch tall aluminum wale-plate at each end of shoring device 100a. These wale-plates are approximately six inches wide and approximately 2 and 1/2 inch in thickness, and they eliminate the need for upright wooden boards.

(101) (c) The operator then selects the proper size and number of shoring devices 100a required to shore or prop the trench effectively. The installer positions plywood, timber uprights or aluminum wale-plates as required after he has descended into the trench, *infra*. Figure 1 illustrates a plurality of shoring devices 100a in a trench, and in which shoring devices 100a support first and second wooden shoring boards and/or aluminum wale-plates.

(102) 2. The operator next determines that outer cam collar 107t is properly positioned over inner cam ring 113h. Prior to installation, the installer will often place tethered straight cam metal pin 170 into one piston aperture 128, 129, 130, 131 to prevent straight

cam metal pin 170 from dangling. However, the installer must remove tethered straight cam metal pin 170 prior to pressurizing shoring device 100a, or straight cam metal pin 170 will prevent full extension of piston 102.

5 (103) (a) The installation pressure is the air pressure required to expand piston 102 laterally from cylinder 101, thus forcing the upright wooden boards and/or aluminum wale-plates into opposing trench walls with attached swivel side plates 103a, 103b. The preferred embodiment of my shoring device 100a requires an installation pressure of approximately 115 to 225 pounds per square inch in the best mode.

10

(104) (b) Under this compressed gas or air pressure, piston 102 extends laterally and distally until both removable swivel side plates both 103a, 103b bear against the wooden shoring boards and/or or wale-plates. First set screw 120a and second set screw 120b quickly engage the wooden shoring boards or aluminum wale-plates after introduction of  
15 pressurized air, thus preventing board or wale-plate random movement

(105) (c) In the best mode, there are at least two shoring devices in one trench whenever shoring devices 100a are the sole protection from wall collapse. For trenches with a depth greater than eight feet, in the best mode there should be a shored length of trench at least  
20 equal to its depth. For example, a trench that is twenty feet long and nine feet deep should have at least nine feet of its length shored, or propped, by my shoring device 100a.

(106) 3. The operator next places a ladder in the trench and descends until his waist is even with the top of the trench. Third persons outside the trench assist by lowering the shoring device 100a to the descending operator with either a rope or webbing.

5 (107) The installer now positions shoring device 100a to the required or desired depth (i.e., no deeper than two feet for the uppermost initial placement, and then no greater than four feet thereafter) within the trench, but he himself does not descend into the trench below his waist. The installer levels shoring device 100a to the horizontal (i.e., parallel to the floor of the trench) and authorizes air pressure to shoring device 100a from third  
10 persons. This air pressure results in immediate lateral extension of piston 102 within cylinder 101.

(108) 4. Vent holes 112 give an audible indication whenever piston 102, which must remain within cylinder 101, reaches its maximum extended position. This indication  
15 occurs whenever approximately 1/3 of piston 102 remains within cylinder 101. At this time, if additional shoring device 100a length is required, then the operator obtains a shoring device with a greater lateral extension.

(109) (a) With piston 102 now fully extended from applied air pressure, the operator  
20 rotates outer cam collar 107a clockwise, until a piston aperture 128, 129, 130, or 131 is closest to a sloping cam surface 107i, 107.

(b) He or she then inserts a straight metal cam pin 170 through this piston aperture and its 180-degree opposing counterpart, such as 128c/130c, 129b/ 131b, as examples.

The operator continues to rotate outer cam collar 107a until straight cam metal pin 170 firmly abuts either sloping cam surfaces 107i or 107j.

5 (110) 5. Immediately after straight metal cam pin 170 engages either sloping cam surface 107i, 107j, the operator continues to rotate outer cam collar 107a until collar 107a can no longer move clockwise. This engagement prevents piston 102 from rotating counter-clockwise and retracting into cylinder 101. This result occurs because mechanically engaged inner cam collar 107t and inner ring 113h (i) tightly abut each other when rotated threaded cam pin 181 lodges against indentation floor 113j; and (ii) are  
10 simultaneously tightly locked against piston 102 and cylinder 101. This combination also presses stop faces 107i, 107j and cam surfaces 107f and 107g directly against piston 102.

(112) Inner ring 113h also grasps piston 102 directly and is braced against counterclockwise rotational force by screws 113a, 113b which connect inner ring 113h to  
15 cylinder 101. Please see Figure 7. In addition, straight cam metal pin 170 prevents piston 102 from retracting into cylinder 101 or collapsing onto the trench floor.

(113) 6. Once outer cam collar 107t and inner ring 113h tightly abut through straight metal pin 170 and threaded pin 181, the operator signals third persons to remove exterior  
20 air pressure from the now extended shoring device 100a. The air hose is then removed from the leveled shoring device 100a to attach to another shoring device 100a. This particular shoring device 100a is now in its extended longitudinal position, and swivel

side plates 103a, 103b engage opposing wood shoring boards and/or aluminum wale-plates with set screws 120.

(114) 7. Now that first shoring device 100a is installed, the installer can further descend  
5 the ladder within the trench, until his waist is even with the level of this initial installed  
shoring device 100a. He then prepares to install a second shoring device 100a at a greater  
depth within the same trench. As the operator progresses deeper into the trench, his next  
"level of protection" is waist height with last installed shoring device 100a.

10 (115) In the best mode of applying improved shoring device 100a, the operator uses two-  
inch by ten-inch Douglas fir timber uprights or aluminum 12- inch wale-plates.  
Aluminum wale-plates are positioned horizontally or vertically. Plywood, timber  
uprights, and 12- inch wale-plates are all satisfactory, as long as these items continuously  
contact trench walls with no gaps or voids. Plywood sheeting is required in all trenches,  
15 regardless of depth, if the operator observes sloughing or raveling (movement of soil  
around or between shoring elements).

(116) In the best mode and preferred embodiment, shoring device 100a is strongest  
whenever the operator positions it completely horizontally within the trench. However,  
20 other embodiments support structures for which a shoring device 100a is most effective  
when positioned vertically. With these embodiments, base plates in place of swivel side  
plates 103a, 103b are necessary for vertical positions. For example, with a single or a  
plurality of shoring devices 100a, a vertical position (or small angle from the vertical)

from the supporting flat surface is recommended for shoring of a vehicle or structure such as a house. In the preferred embodiment shoring device 100a is installed at an angle which deviates from the horizontal no more than 15 degrees.

5 (117) Depending upon the circumstances, the engineer may require plywood in addition to either wooden upright boards or wale-plates. Where plywood is necessary, it is preferably 1 and 1/8 inch Douglas fir or 14-ply white birch. Douglas fir is a tree species, while a "number 2" designation refers to the wood quality and grade. These particular designations are well known in the rescue industry, as well as the lumber industry. The  
10 plywood must be at a minimum: 1 and 1/8 inch thick, approximately four feet wide and approximately eight feet long.

(118) Alternatively, the installer can use the 14-ply (fourteen layers glued or laminated together) white birch plywood, which is approximately 3/4 inch thick, four feet wide and  
15 eight feet in length. Other dimensions are also within the scope of my invention, as the operator is not limited to a certain plywood size.

#### **Removal of Multiple Shoring Devices 100a within an Excavation or Trench**

(119) In a reverse chronology of the installation described immediately *supra*, the  
20 operator always removes a plurality of shoring devices 100a from the trench bottom to the upper trench edge. In this manner, the operator remains waist high to the last extended installed shoring device 100a within a trench. An operator at this "level of protection" is either completely exterior to the trench or at the level of the next highest

fully installed shoring device 100a. In the proper level, the operator next follows these steps:

(120) 1. Prior to disengagement and removal of each shoring device 100a, air pressure is re-introduced through gas inlet 111 by a method well known in this particular industry. After re-introduction of air pressure, the operator releases threaded pin 181 by turning handle 181b counter-clockwise and removing threaded stem 180 from contact with indentation floor 113d. Each shoring device 100a requires the same pressure upon removal from the trench as it did during installation.

(121) 2. With threaded pin 181 no longer in contact with indentation floor 113d, the operator rotates outer cam collar 107t counterclockwise until straight metal cam pin 170 no longer abuts sloping cam surface 107f. He or she then removes straight metal cam in 170 to retract shoring device 100a.

(122) In sum, the operator removes the shoring device 100a with the same procedures as for installation, except that he or she need not rotate outer cam collar 107 clockwise. Instead, the operator rotates threaded pin 181 by handle 181b counterclockwise to release outer cam collar 107, thereby requiring less exertion.

(a) Shoring device 100a does not collapse at this point, because the air pressure provides continuing extension of piston 102. Without the continuing air pressure to a shoring device 100a without pin support, the trench wall could collapse.



(123) (b) With the air pressure still connected to gas inlet 111, the operator now ascends the ladder to either remove another shoring device 100a, or exit the trench. After the operator is in a safe position, the air pressure through gas inlet 111 is removed, and third persons assist in lifting this particular shoring device 100a from the trench with rope or a webbing material.

(124) Wherever possible, back filling replaces soil which was removed from a trench prior to the above-described operation. In the best mode of using my device 100a, back filling is recommended after all shoring devices 100a are removed from the trench, and after the trench operation is complete. In the best mode, for trenches with a depth greater than eight feet, the length of the trench shored should equal the actual trench depth. Back filling can also be by concrete or wooden blocks, and is completed as each shoring device 100a is removed.

(125) Operators should not use my shoring device 100a in trenches, which are wider than 15 feet or at a depth other than five to twenty feet. For depths greater than twenty feet, a registered engineer should be consulted for the appropriate wood or wale-plate shoring requirements.

#### **Materials comprising shoring device 100a**

(126) (1) The preferred straight cam metal pins 170 are available from:

PivotPoint

P.O. Box 488

(127) Straight cam metal pins 170 have round "key rings" at the upper end of each pin to prevent slippage through piston 102. The recommended models are:

5        (a) 5/8 inch by 3.5-inch detente ring pins 105c with a collar (12L14 Carbon Steel Zinc w/ yellow chromate finish or stainless steel), where 5/8 inch is the diameter of the pin shaft;

      (b) 5/8 inch by four and 3/4 inch ring pin with collars (Grade 5, 1144 carbon steel with zinc and yellow chromate finish); and

10       (c) 5/32 x 1 and 1/4 inch, 4-20 stainless steel slotted spring pin.

Detente pins 105a, 105b with small detente beads 45 (See Figure 3), are preferably made of carbon steel or stainless steel.

(128) (2) Aluminum sand casted components such as inner ring 113h, outer cam collar  
15    107t, threaded cam pin 181, cylinder plug 155 and swivel side plates 103a, 103b are custom made by:

Louis Meskan Foundry

2007-13 North Major Ave.

Chicago, Illinois 60639

20    These 356 -T components are made by initially pouring molten metal into a mold and are designated in the industry as "sand castings."

(129) (3) Aluminum extruded cylinders 101, pistons 102 and 12- inch aluminum wale-plates are custom made by:

Precision Extrusions

720 East Green Street

5 Bensenville, Illinois 60106

The preferred material for cylinder 101 is aluminum type 6061-T6, which is extruded, and the dipped in cold water during a process well known in this particular industry. The pistons 102 and wale-plates are also of the 6061-T6 variety.

10

(130) (4) Circular rubber (55 durometer neoprene) end cups 155b, 156 are custom-made by:

15

Packing Seals, Inc.

3507 North Kenton Ave.

Chicago, Illinois 60641

(5) The polyvinyl chloride coated stainless steel lanyard 145 which connects straight

20

metal cam pin 170 to outer cam collar 107 is available from:

Lexco Cable

2738 West Belmont Ave.

Chicago, Illinois 60618

Model: 3/32, 7x7 G.A.C. (galvanized aircraft cable) coated with 3/16 clear polyvinyl

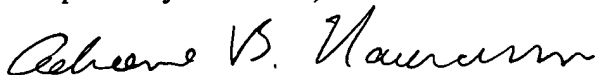
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chloride

(131) The above is a description of the preferred embodiment of my improved shoring device 100, as well as the best mode of its application. However, these skilled in the art may envision other possible variations within the invention's scope, by changing the dimensions and shapes of its components. Accordingly, since my invention is possible in  
5 other specific forms without departing from the spirit or essential characteristics thereof, the embodiments described herein are considered in all respects illustrative and not restrictive.

(132) All changes, which come within the meaning and range of equivalency of the  
10 claims, are intended to be included therein. As such, this above discussion describes the preferred embodiment, but in no way limits the scope of my invention. In addition, the detailed description of my attachments and extensions in no manner limits the spirit or scope of additional accessories, which are compatible with the scope of my invention.

15 Respectively submitted,



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On behalf of

James G. Sullivan

Inventor and Applicant